THE EFFECTS OF PLYOMETRIC AND SAQ TRAINING ON SELECTED SKILLS AMONG FEMALE SOFTBALL PLAYERS

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Introduction

Sports performance is considered as a prestigious issue all around the globe during recent years. Training is not recent discovery. In ancient times, people systematically trained for military and Olympic endeavours. Today athletes prepare themselves for a goal through training. Most of the coaches are searching for effective method of training methods. Better performance can only be possible through scientific, systematic and planned sports training as well as channelizing them into appropriate games and sports by finding out their potentialities. Training is extremely important and should form an integral part of all elite athlete's daily routines. Training allows the body to gradually build up strength and endurance, improve skill levels and build motivation, ambition and confidence. Training also allows athletes to gain more knowledge of their sport as well as enabling them to learn about the importance of having a healthy mind and body. In terms of physical effects of training, regular exercise increases muscle tone, facilitates good circulation, improves strength, agility and flexibility and improves the rate of waste product disposal. Regular training also speeds up recovery time following physical exercise; this enables the body to cope with the demands of training more effectively and makes it more resistant to injury and illness. Training also has benefits for mental health as it improves concentration and increases self-esteem.

Plyometric Training:

Plyometric is the term now applied to exercises that have their roots in Europe, where they were first known simply as "jump training". Interest in this jump training increased during the early 1970s as East European athletes emerged as powers on the world sport scene. As the Eastern bloc countries began to produce superior athletes in such sports as track and field, gymnastics, and weightlifting, the mystique of their success began to center on their training methods. Training is extremely important and should form an integral part of all elite athlete's daily routines. Training allows the body to gradually build up strength and endurance, improve skill levels and build motivation, ambition and confidence. Training also allows athletes to gain more knowledge of their sport as well as enabling them to learn about the importance of having a healthy mind and body. In terms of physical effects of training, regular exercise increases muscle tone, facilitates good circulation, improves strength, agility and flexibility and improves the rate of waste product disposal. Regular training also speeds up recovery time following physical exercise; this enables the body to cope with the demands of training more effectively and makes it more resistant to injury and illness. Training also

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SAQ (Speed, Agility and Quickness) Training:

Speed, agility and quickness training has become a popular way to train athletes. With continuously increasing need to promote athletic ability, this type of training has proven to enhance the practical field abilities of participants in a wide variety of sports. Nearly every sport requires fast moments of either the arms or legs, and speed, agility and quickness training can improve skill in precisely These areas. Hence all athletes can benefit when speed, agility and quickness training is integrated into their training program.

This training has been there for many years but number of athletes do not perform it because of lack of education, not knowing the specific benefits of it and not knowing how to integrate it into complete training program. If we think of critical game situations in various ports we come to know that the ability to shift speeds can win game for you. For example, the ability to speed up while running the bases in softball may make a difference between winning and losing. Unfortunately many people think that speed is something that someone is born with and not something that can be improved by proper training. However a proper speed development program can increase the speed to a noticeable extent.

Agility is the key factor in all sports because constant need to change direction in many Sports requires the athlete to maintain a good posture over his or her base of support in order to remain upright. For example, while stealing the bases in softball in order to avoid the tag made by defensive team athlete has to change his directions several times while maintaining the speed.

Successful performance by an athlete depends heavily on his or her ability to react quickly. In many sports performances athletes require to accelerate or decelerate very quickly. Therefore athletes with greater picnics and better reaction time usually seen performing well.

Softball:

Softball**,** a variant of baseball and a popular participant sport, particularly in the United States. It is generally agreed that softball developed from a game called indoor baseball, first played in Chicago in 1887. It became known in the United States by various names, such as kitten ball, mush ball, diamond ball, indoor–outdoor, and playground ball. There were wide variances in playing rules, size and type of playing equipment, and dimensions of the playing field.

In 1923 a rules committee was appointed to publish and circulate a standard set of rules. The committee was later enlarged to form the International Joint Rules Committee on Softball, which came to include representatives of a number of organizations that promote and sponsor softball. The Amateur Softball Association of America, organized in 1933, came to be the recognized governing agency for promotion and control of organized national competition.

The Fédération Internationale de Softball (International Softball Federation), which was formed in 1952, acts as liaison between more than 40 softball organizations of several countries. Headquarters are in Oklahoma City, Oklahoma. The federation coordinates international competition and regular regional and world championship tournaments for men and women. In 1996, a women's softball competition was added to the Olympic Games.

Softball was first played in India in 1944 by United States Army servicemen stationed in Jodhpur, Rajasthan during World War II. Some locals played with the Americans and learned the game from them. Among them was Dashrath Mal Mehta, considered the father of Indian softball. Mehta founded the Softball Association of India in Jodhpur on 21 November 1961 with the support of L.M. Singhavi, Anand Singh Kachawa, Madanlal Pungalia, and K.D. Gautam. The Association came into contact with members of the International Softball Federation (ISF), the sport's international governing body, in 1964 and invited them to play a game in India. The SBAI officially became affiliated with the ISF in 1965.

Statement of Problem:

The purpose of the study is to find out the effects of plyometric and SAQ training on selected skills among the female softball players.

Significance of the study:

Various types of exercises can be used for body conditioning, but plyometric exercises are particularly useful. These are specific exercises typically only involving your own bodyweight or basic pieces of equipment that stretch and then contract the muscles, helping to tone and tighten your muscles and increase speed and strength. For softball players, plyometric exercises can be a newfound training boost. Exercises in this category are designed to help improve explosiveness and body control. This makes them great for athletes looking to put some bounce in their gym time. Including plyometric exercises in your training for running speed improvement can help add depth to your routine. These movements can vary in the amount of stress they can put on the body. Adding plyometric exercises with varying intensity can help train you for multiple conditions. If you're focusing on improving your skills in a full-body sport like softball, you need to condition both your upper and lower body. This kind of study may lay a foundation for a new properly designed method of training female softball players by specifying plyometric exercises to improve specific softball skills.

Nowadays softball in India is growing rapidly. In major cities of India It is seen that teachers and coaches are taking sincere efforts towards improving the performance of female softball players by giving them training for improving their skills related to the game of softball. But the scientific approach and properly designed training sessions still seem lagging.

In order to counter this problem specially in female softball players researcher has decided to make a sincere effort towards designing a proper training program including plyometric and SAQ exercises in order to improve the performance in the skills related to the game of softball.

Purpose of Research:

1. This study will help to assess the effect of plyometric training on selected skills among the female softball players.
2. This study will help to assess the effect of SAQ training on selected skills among the female softball players.
3. The result of the study will help to introduce the training packages for female softball players.
4. The result of the study will motivate the players to practice the game softball.

Delimitations:

1. The study was delimited to Sixty Inter-Collegiate female softball players from Savitribai Phule Pune University, Maharashtra.
2. The study was confined to Inter-Collegiate female softball players between the age group of 16 and 20 years.
3. This study was delimited to only plyometric and SAQ training.

Limitations:

This study was limited to the following aspects.

1. The impact of training schedules, previous experiences, motivational factors and various physical activities on the subject's playing ability were not taken into account.
2. Hereditary and environmental factor, which contribute to both physical and mental efficiency will not be controlled.
3. No attempt will be make to determine whether the subjects are having the some degree of motivation during the various stages of training and testing periods.
4. Variations in performance due to diet, climatic conditions and other environmental factors that might affect the study, were not taken into consideration.
5. Since the human elements are involved in the test administration even slight error in measurement and timings which might affect the results were also considered as limitations of the study.
6. The fatigue factors of the players and the carry over knowledge of the skills which might affect the performance in the tests were considered as limitations of the study.

Working Definitions:

1. **Speed:** The ability to perform a movement within a short period of time (Birch, MacLaren, & George, 2005).

   Speed is the maximum rate at which a person is able to move his /her body (Davis et al., 2000).
2. **Agility:** Agility is the physical ability that enables a person rapidly to change body position and direction in a precise manner (Davis et al., 2000).
3. **Plyometric:** A jump based explosive type of activities stressing the stretch-shortening cycle consisting of jumps, hops, skips, bounds, and throws (Bachle.Thomas, 2008).
4. **Plyometric training:** Plyometric training aimed at linking strength with speed of movement to produce power (Chu, 1998).
5. **SAQ training:** Speed, agility and quickness are some of the most significant, and visible components of athletic success. An improvement in the ability to react quickly, apply significant force rapidly in the appropriate direction and to redirect that force if needed is the ultimate goal of a program to improve speed, agility and quickness.
6. **Softball :** Softball is a variant of baseball played with a larger ball on a smaller field. Invented in 1888 in Chicago as an indoor game, it was at various times called indoor baseball, mush ball, playground, softbund ball, kitten ball, and, because it was also played by women, ladies' baseball. The name softball was given to the game in 1926.

Hypothesis:

1. **Null Hypothesis:** There would not be any significant improvement in selected Softball skills, from the base line to post training due to the influence of plyometric and SAQ training among the female softball players.
2. **Research Hypothesis:** There would be a significant improvement in selected Softball skills, from the base line to post training due to the influence of plyometric and SAQ training among the female softball players.

Chapter 2

Review of Literature

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Vincent Paul (2014), while studying the Effect of plyometric and SAQ training on selected physiological and performance variables among football players showed in the results of his research study that plyometric training and SAQ training could enhance the performance of football players in almost all the physiological, bio-chemical and performance variables. Hence it is recommended that coaches and physical educators in the game of football should give due importance to include plyometric training and SAQ training in their schedules. It was also recommended that a football team at any level should have knowledge about plyometric training and SAQ training to train the players for enhancing their performance.

Malempati, Bujjibabu (2015), determined the Effect of plyometric and speed agility and quickness SAQ training on selected physiological and physical fitness attributes of male handball players. Based on the results of the study he made following recommendations - Both the Plyometric and SAQ training can be implemented for the purpose of enhancing the physiological and physical fitness attributes of handball players. Yet, plyometric training is better than SAQ in altering per cent body fat, lean body mass, leg explosive power in terms of vertical and horizontal, and muscular endurance, while SAQ training has the upper hand as compared to plyometric training with regard to changing anaerobic power, fatigue index, speed, agility and flexibility. Thus, the investigator suggests SAQ training for six weeks as the effective training modality in enhancing most of the physiological and physical fitness attributes of handball players.

The findings of the study also clarify that both Plyometric and SAQ training may not be utilized for the purpose of developing aerobic capacity of the players, instead some other training modalities of aerobic nature may be suggested 200.

Ambili Raghwan (2019), Studied the Effect of two volume of polymetric training on different surface combined with SAQ drills on performance parameters of Junior Volleyball players. Stated in the results of his study that the assessment of systematic studies and the use of scientific methods is a prerequisite for high performance in sport and volleyball as well. At the present time volleyball has become a sport in which physical strength as well as technical

and tactical elements are used at the top level. In the present study, low volume plyometric on mud and grass surfaces combined with SAQ drills, and moderate volume plyometric on mud and grass surfaces combined with SAQ drills much influenced all the performance parameters. As a result, it is suggested to the physical education related professionals and coaches to accept this practice for superior progress of performance parameters of volley ball players. Further the moderate volume plyometric on grass surface combined with SAQ drills are highly recommended to those who need to develop speed, explosiveness, anaerobic capacity and agility. The outcome of the present study indicates that different experimental plyometric training volume and surfaces combined with speed, agility and quickness drills are associated with different performance parameters. The gains that we have observed should be of great interest for volleyball coaches, because performance of this sport relies greatly on specific power, jump, sprint and hitting abilities, all of which were enhanced by the plyometric training regimen. We strongly recommended that volleyball coaches implement different volume and surface plyometric training enhance the performance of their players.

Senthilkumar V. (2014), was to determine the Effect of SAQ training circuit resistance training and plyometric training on selected motor fitness variables among intercollegiate football players. Based on the results of the study, drew the following conclusions that there was a significant difference among SAQ training, circuit resistance training, plyometric training and control groups on selected motor fitness variables namely muscular strength, muscular endurance and cardio respiratory endurance among inter collegiate men football players. Also there was a significant difference among SAQ training, circuit resistance training, plyometric training and control groups on selected motor fitness variables namely speed, speed endurance and agility among inter collegiate men football players. There was a significant difference among SAQ training; circuit resistance training, plyometric training and control groups on cardio respiratory endurance among inter collegiate men football players. Also there was a significant improvement on motor fitness variables namely muscular strength, muscular endurance, speed, speed endurance, 122 leg explosive power, agility and cardio respiratory endurance due to SAQ training, circuit resistance training and plyometric training. The improvement on muscular strength, muscular endurance and cardio respiratory endurance was in favour for circuit resistance training group. The improvement on speed, speed endurance and agility was in favour for SAQ training. The improvement on leg explosive power was in favour for plyometric training.

Das. Subir (2017), Studied the Comparative effect of plyometric training and weight training on development of different forms of acceleration speed Based on the results of the study, drew the following conclusions that the acceleration for both rectilinear and curvilinear motion increases through the proper strength training programme of weight training and plyometric training. The acceleration ability for few distance intervals between the pre and post treatment for rectilinear motion differ significantly. The acceleration ability for few distance intervals between the pre and post treatment for curvilinear motion differ significantly and Plyometric training appears to be slightly better improving acceleration than weight training.

Matavulji *et al.* (2001) looked into the effect of plyometric training on the jumping performance of junior Volleyball players. Although the plyometric training has showed its efficiency, it remains generally unknown whether a limited amount of plyometric training could improve movements in subjects who already demonstrate a high level of performance. While the control group participated only in regular midseason training activity, the other two groups performed a limited amount of plyometric training, employing drop jumps from the height of either 50 cm, or 100 cm. The heights of the maximal vertical jump, as well as the maximal voluntary force and the rate of force development of the hip and knee extensors were tested prior to as well as after the training. An increase in the maximal vertical jump, as well as maximal voluntary force of the hip extensors and rate of force development of the knee extensors was observed in both experimental groups, while no significant changes were recorded in the control group.

Brown *et al.* (1986) examined the effect of plyometric training on the vertical jump capability of male high school Volleyball players (N=26). These players were randomly assigned to an experimental training group (the plyometric group) and a control group. The experimental training group performed three sets of ten depth jumps, three days per week for twelve weeks, whilst the control group only performed regular Volleyball training. Results showed that the plyometric group imshowed significantly ($p<0.05$) in the vertical jump with arm assistance compared to the control group. Neither group differed significantly ($p>0.05$) in the vertical jump without arm assistance. In the plyometric group, 57% of the vertical jump gain was due to jumping skill improvement, and 43% was due to strength gain. Plyometric training appeared to enhance arm coordination.

Solanikidis et al, (2008). was to determine the effectives of plyometric, tennis drills and combined on reaction lateral and linear speed, power and strength in novice tennis players. There was a significant difference in lateral speed (side-steps) between the 2 sides PT improved fitness characteristics that rely more on reactive strength and powerful push-off of legs such as, lateral reaction time, 4-m lateral and forward sprints, drop jump and maximal force. TDT improved all 4-m and 12-m sprint performances, whereas CT appeared to incorporate the advantage of both programs and improved most tests items.

Toumi H, Best et al, (2004). was to compare the effects of plyometric training on jump performance. Thirty males between the ages of 19 and 22 volunteered for the8- week experiment. Subjects were divided into the following three groups: training groups (1)(TG1) training group2 (TG2) and control group (CG, n=6). Each of the 2 experimental groups underwent a unique training regimen. There was an increase in leg extension force, velocity and electrical activity for SJ and CMJ for the two training groups($P<0.05$). However, TG1 showed a significant advantage in CMJ performance as well as a significant decrease in TR compared to the TG2 ($P<0.05$). The results of this study show that when plyometric training performed with rapid stretch contraction, the CMJ jump height increase and the TR decrease.

Michael *et al*. **(2006)** assessed the effects of 6-week plyometric training program on agility. Subjects were divided into two groups, plyometric training and a control group. The plyometric training group performed in a six week plyometric training program and the control group did not perform any plyometric training techniques. All subjects participated in two agility tests: T-test and Illinois Agility Test, and a force plate test for ground reaction times both pre and post testing. Univariate ANCOVAs were conducted to analyse the change scores (post – pre) in the independent variables by group (training or control) with pre scores as covariates. The result revealed a significant group effect $F2, 26 = 25.42$, $p=0.0000$ for the T-test agility measure. For the Illinois Agility test, a significant group effect $F2, 26 = 27.24$, $p = 0.000$ was also found. The plyometric training group had quicker post-test times compared to the control group for the agility tests. A significant group effect $F2, 26 = 7.81$, $p = 0.002$ was found for the Force Plate test. The plyometric training group reduced time on the ground on the post-test compared to the control group. The results of this study show that plyometric training can be an effective training technique to improve an athlete's agility.

Kemp (1998) three different training programmes, including a gymnasium programme, a plyometric and a combined gymnasium and plyometric programme, was implemented in

order to see which of these programmes would have a positive effect on certain elements, relevant to netball players. These elements include speed, agility, suppleness, explosive power and strength. The results of this study showed that the combined programme would have a positive effect on the bio motor abilities of the netball players.

Khlifa, R, Aouadi, et al, (2010). investigated was to examine the effect of a standard plyometric training protocol with or without added load in improving vertical jumping ability in male Volleyball players. Twenty-seven players were randomly assigned to 3 groups: a control group (no plyometric training), plyometric training group (PG), and loaded plyometric group (LPG, weighted vests 10-11% body mass). The results showed that SJ, CMJ, and 5JT were significantly improved only in the PG and LPG groups. The best effects for jumps were observed in LPG ($p < 0.01$), which showed significantly higher gains than the PG ($p < 0.05$). Plyometric training program may result in greater vertical and horizontal-jump performances in Volleyball players.

Santos EJ, Janeira MA., et al, (2010). conducted on the Effects of Plyometric Training Followed by Detraining and Reduced Training Periods on Explosive Strength in Volleyball Players. All participants were assessed on squat jump, countermovement jump, Abalakov test, depth jump, mechanical power, and medicine ball throw at the beginning and at the end of the 10-week in-season plyometric training and on weeks 4, 8, 12, and 16 of the in-season detraining and reduced training periods. In the first phase of the study, the experimental group significantly increased all the assessed indicators ($p < 0.05$). plyometric training showed positive effects on upper- and lower-body explosive strength in adolescent male Volleyball players. These results highlight the unique power that Volleyball-specific training seems to have on the sustainability and maintenance of sport performance.

Meylan *et al.* **(2009)** investigated the effects of in-season plyometric training within soccer practice on explosive actions of young players. In soccer, explosive actions such as jumping, sprinting, and changes of direction are essential to optimal performance not only in adults, but also in children's games. Fourteen children (13.3 +/- 0.6 years) were selected as the training group (TG) and 11 children (13.1 +/- 0.6 years) were defined as the control group (CG). All children were playing in the same league and trained twice per week for 90 minutes with the same soccer drills. The TG followed an 8-week plyometric program At baseline and after training, explosive actions were assessed with the following 6 tests: 10-meter sprint, agility test, 3 vertical jump tests (squat jump [SJ], countermovement jump contact test and

multiple 5 bounds test. Plyometric training was associated with significant decreases in 10-m sprint time (-2.1%) and agility test time (-9.6%) and significant increases in jump height for the CMJ (+7.9%) and CT (+10.9%). No significant changes in explosive actions after the 8-week period were recorded for the CG. The current study demonstrated that a plyometric program within regular soccer practice improved explosive actions of young players compared to conventional soccer training only.

Diallo *et al.* **(2001)** conducted a study on the effects of plyometric training on physical performance in soccer players**.** Twenty boys aged 12-13 years were divided in two groups (10 in each): jump group (JG) and control group (CG). JG trained 3 days/week during 10 weeks, and performed various plyometric exercises including jumping, hurdling and skipping. Jumping power was assessed by using the following tests: countermovement jump (CMJ), squat jump (SJ), drop jump (DJ), multiple 5 bounds (MB5) and repeated rebound jump for 15 seconds (RRJ15). During this period no significant performance increase was obtained in the CG. After the 8-week of reduced training, except Pmax ($p<0.05$) for CG, any increase was observed in both groups.

Thomas *et al.* **(2009)** compared the effects of two plyometrics training techniques on power and agility in youth soccer players. Twelve males from a semi-professional football club's academy were randomly assigned to 6 weeks of depth jump (DJ) or countermovement jump (CMJ) training twice weekly. Participants in the DJ group performed drop jumps with instructions to minimize ground-contact time while maximizing height. Participants in the CMJ group performed jumps from a standing start position with instructions to gain maximum jump height. Post training, both groups experienced improvements in vertical jump height and agility time and no changes in sprint performance. There were no differences between the treatment groups.

Ronnestad *et al.* **(2008)** compared the short-term effects of strength and plyometric training on sprint and jump performance in professional soccer players. Subjects in the intervention team were randomly divided into 2 groups. There were no significant differences between the ST+P group and ST group. Thus, the groups were pooled into 1 intervention group. The intervention group significantly improved in all measurements except CMJ, while the control group showed significant improvements only in PP20. There was a significant difference in relative improvement between the intervention group and control group in 1RM half squat, 4BT, and SJ. However, a significant difference between groups was not observed in PP20,

PP35, sprint acceleration, peak sprinting velocity, and total time on 40-m sprint. The results suggest that there are no significant performance-enhancing effects of combining strength and plyometric training in professional soccer players concurrently performing 6 to 8 soccer sessions a week compared to strength training alone.

Chelly *et al.* ***(*2010)** investigated the effects of in-season short-term plyometric training program on leg power, jump- and sprint performance of soccer players. There was also a significant increase ($p < 0.05$) in thigh muscle volume, but leg muscle volume and mean thigh cross-sectional area remain unchanged. We conclude that biweekly plyometric training of junior soccer players (including adapted hurdle and depth jumps) improved important components of athletic performance relative to standard in-season training. Accordingly, such exercises are highly recommended as part of an annual soccer training program.

Sampaio *et al.* **(2010)** compares the short-term effects of complex and contrast training (CCT) on vertical jump (squat and countermovement jump), sprint (5 and 15 m), and agility abilities in soccer players. Twenty-three young elite Portuguese soccer players (age 17.4 +/- 0.6 years) were divided into 2 experimental groups (G1, n = 9, and G2, n = 8) and 1 control group (G3, n = 6). Groups G1 and G2 have done their regular soccer training along with a 6-week strength training program of CCT, with 1 and 2 training sessions .wk, respectively. G3 has been kept to their regular soccer training program. Each training session from the CCT program was organized in 3 stations in which a general exercise, a multiform exercise, and a specific exercise were performed. results suggested that the CCT induced the performance increase in 5 and 15 m sprint and in squat jump. Vertical jump and sprint performances after CCT program were not influenced by the number of CCT sessions per week (1 or 2 sessions./wk). From the obtained results, it was suggested that the CCT is an adequate training strategy to develop soccer players' muscle power and speed.

Nimphius et al., (2010) conducted a study on the relationship between Speed, Strength, power and Change of Directional Performance of Female Softball Players. Investigation of (a) cross-sectional relationship of performance variables and strength, power in trained female athletes and (b) find out if the relationship between these variables changes over the course of a season was the main aim of the study. The testing sessions occurred pre, mid, and post a 20-week training period. Ten female softball players (age = 18.1 6 1.6 years, height = 166.5 6 8.9 cm, and weight = 72.4 6 10.8 kg) from a state Australian Institute of Sport softball team were tested for peak force (PF), peak velocity (PV), maximal lower body

strength(one repetition maximum [1RM]), and peak power (PP) during jump squats unloaded and loaded, unloaded countermovement vertical jump height (VJH)1 base and 2 base sprint performance and change of direction performance on dominant and non dominant sides. Pearson 41 product–moment correlation coefficient at each testing session was used to establish the Relationship between body weight (BW), relative strength(1RM/BW), VJH, relative PP, relative PF, PV, speed, and change of direction variables. There were no significant relationships between VJH and any measure of performance at any time point. However, Substantial relationships were found across all time points with BW, speed, and change of direction measures (r = 0.70–0.93) and relative strength and measures of speed and change of direction ability (r = 20.7320.85). It can be concluded that relative strength and BW have strong correlations with speed and change of direction ability, and these correlations remain consistent over the course of the season.

Chhina, (2017) to evaluate the relationship among the body compositions to throwing performance of softball players. For the study 45 softball players were taken who represent their college in inter collegiate competition. Age of the players is between 17 to 19 years. Anthropometric variables like height, weight and skin fold thicknesses were assessed. AAHPERD softball skill test battery was used to assess throwing skills of the softball players. To test the statistical data the Karl Pearson's co-efficient of correlation was computed to assess the relationship between body compositions to the throwing performance. It was concluded that height, weight, BMI and skin fold thickness shows there a negative relationship with throwing performance among softball players.

Yanagisawa et al. (2009) conducted a study to determine the anthropometric characteristics of Japanese baseball and softball players. Subject taken to the present study are 26 pitchers and 30 positional players, all the 56 players are the professional baseball players and 39 elite amateur female softball players of which (9 pitchers and 30 position players). All the subjects were assessed for height, weight, body fat 43 percentage, upper and lower limb girths, and lengths. The subcutaneous adipose and muscle thickness of the limbs and abdomen and muscle cross-sectional area of the thigh and trunk were also measured by a B-mode ultrasound apparatus and a magnetic resonance imaging system, respectively. Baseball pitchers showed significantly greater values than position players for body fat percentage, thigh and waist girths, triceps skin fold thickness, thigh skin fold thickness, and calf skin fold thickness and muscle thickness (the subscapular site, the anterior side of the thigh). Softball pitchers showed significantly greater values than position players for bodyweight, upper and

lower limb lengths and girths, subscapular, thigh and abdomen skin fold thicknesses, and muscle thickness (the forearm, anterior side of the upper ann, anterior side of the leg). Furthermore, baseball players showed significantly greater cross-sectional areas in the non-throwing side of the trunk muscle than in the throwing side, particularly in lateral abdominal muscles. Softball players showed more differences between pitchers and position players in anthropometric measurements than baseball players. In contrast, baseball pitchers exhibited side-to-side differences in the trunk muscle cross sectional area compared to softball pitchers.

Chapter 3

Methodology

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This chapter explained the methodological details used to implement the study. Specifically, presented here are the general perspective and context of the study, an overview of the participants and a description of the procedures used in data collection, and an explanation of data analysis.

Population:

Population comprises female softball player in workspace of Savitribai Phule Pune University.

Sample:

The method of sample was purposive –A non-random method of sampling design for Students with a specific purpose. Total 50 girls will be selected for research purpose, out of which 25 girls will be in Experimental group and 25 girls in control group.

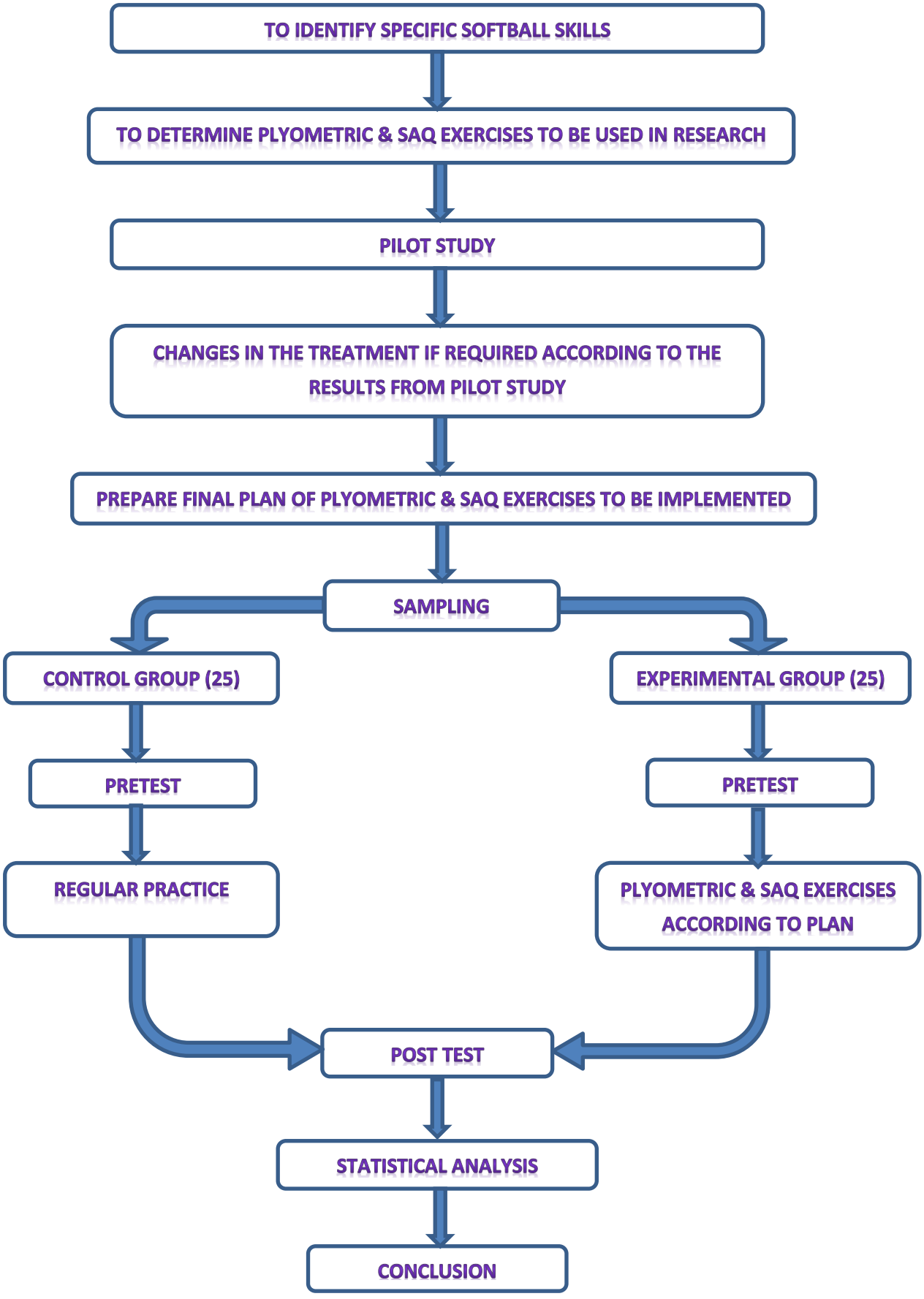
Demographic Information:

The data will be collected through respondents in the form of different tests. The demographic information about, age, height, weight etc. will be obtained before seeking responses from Softball players.

Research design:

The research design refers to “the researcher’s overall plan for testing the research hypotheses” .This study involves a cross sectional, comparative pre and post test of two groups of students as experimental research. Since experimental group will be taken by the investigator so this study will be conducted in an experimental design.

Research Design


TO IDENTIFY SPECIFIC SOFTBALL SKILLS
TO DETERMINE PLYOMETRIC & SAQ EXERCISES TO BE USED IN RESEARCH
PILOT STUDY
CHANGES IN THE TREATMENT IF REQUIRED ACCORDING TO THE RESULTS FROM PILOT STUDY
PREPARE FINAL PLAN OF PLYOMETRIC & SAQ EXERCISES TO BE IMPLEMENTED
SAMPLING
CONTROL GROUP (25)
EXPERIMENTAL GROUP (25)
PRETEST
PRETEST
REGULAR PRACTICE
PLYOMETRIC & SAQ EXERCISES ACCORDING TO PLAN
POST TEST
STATISTICAL ANALYSIS
CONCLUSION

Warm up protocol for experimental groups:

Sr. No.	Type of Exercise	Duration in Minutes
1	Jogging	3
2	Static stretching of upper body and lower body muscles	3
3	Calisthenics	2
4	Breathing and chest expansion exercise	2

Description of plyometric exercises:

Sr. No.	Plyometric Drill	Technique
Week 1-12 (3 Days per week)		
1	**Squat Jump (10 repetitions)**	Stand with feet shoulder width apart trunk fixed forward slightly with back straight in a neutral position. Arms in the ready position with elbows flexed at approximately 90 degree. Thighs are parallel to ground and immediately explode upwards vertically and drive arm up. Land on both feet rest 1-2 seconds and repeat.
2	**Box Jump (10 repetitions)**	Stand facing box with feet slightly wider than hip- width apart. Hold a semi squat position and immediately jump up into box step back down and repeat.
3	**Tuck Jump (10 repetitions)**	Stand with feet shoulder width apart, knees slightly bent with arms at side. jump up bringing knees up to chest and on balls of feet and repeat immediately.
4	**Split Jump (10 repetitions)**	Stand with feet hip width apart take left leg and step back approximately 2 feet standing on the ball of back foot. Feet positioned at a staggered stance with head and back erect and straight in a neutral position. Lower body by bending at right hip and knee until thigh is parallel to floor then immediately explode vertically. Switch feet in the air so that the back foot lands forwards and vice

		versa.
5	**Pelvic Bridge (10 repetitions)**	The athlete lies supine with hips and knees flexed and with feet planted on the ground. The athlete then extends the hip and elevates the trunk of the ground to execute the pelvic Bridge. This position should be held for 3 seconds before starting the next repetition. The exercise is used to established movement pattern that involves moving the hips through gluteus recruitment.

Description of SAQ exercises:

Sr. No.	**SAQ Drill**	**Purpose**
Week 1 & 2 (3 Days per week)		
1	**A Skips(Speed) (2 Minutes)**	March using perfect posture and arm action. The knee on the recovery Leg should be brought high and stay fully flexed while keeping the ankle close to the gluteus and dorsiflexed. When the recovery knee is at the highest point. Deposit ground foot should emphasize plantar flexion. Keep the upper body in an upright and steady position at all times, the foot strike should be quiet but explosive, emphasizing muscle stiffness at the ankle. Be careful not to slam the foot onto the ground.
2	**Zig Zag(Agility) (2 minutes)**	Start in two point stance. Stand facing row of 10 cones each cone one yard apart. Quickly step forward and diagonally with the right foot to the right of the first cone and then slide the left foot next to the right foot. Lead with the left foot to the left side of the next cone and then slide the right foot up to the left foot. Zigzag through all the cones quickly and explosively.

3	**Medicine ball upper body throw(Quickness) (10 repetitions)**	Using a wall load the ball over and behind the head with two hands extending the entire body. Throw the ball at the wall with both hands and catch it with both hands. Keep a parallel stance and feet flat during the loading or cocking phase.
Week 3 & 4 (3 Days per week)		
1	**Tire pulls(Speed) (2 repetitions of 50 m)**	Attach a weighted sled or a car tyre to yourself which you then drag. Emphasize proper sprinting mechanics. Do not make the sled so heavy that acceleration mechanics are needed to pull it.
2	**Cross over shuffle(Agility) (2 Minutes)**	Stand with the ladder to your right. Cross over with the left foot to the first square of the ladder. Laterally step with the right foot to the right side of the ladder. Immediately crossover with the right foot to the second square of the ladder. Laterally step with the left foot to the left side of the ladder. Repeat. Remember only one foot is in the ladder at any one time.
3	**Partner blind tosses(Quickness) (20 Tosses)**	While standing in ready position have a partner stand behind you and Toss a tennis ball over one of your shoulders. Reacting as you see the ball sprint and catch it before it bounces twice.
Week 5 & 6 (3 Days per week)		
1	**Uphill Acceleration run(Speed) (5 repetitions)**	Use a hill with an incline of 20 to 35 degrees. Take a 4 to 8 second runs up the hill. Count your strides and mark your spot at your chosen time. Try to beat the distance with your strides in subsequent timed runs.
2	**Z Pattern run(Agility) (3 repetitions)**	Position three cones on two lines 5 yards apart such that the cone on line 1 are at 0, 10 and 20 yards and the cones on the line 2 are at 5, 15 and 25 yards.

		Start with two point stance. Run diagonal 5 yards to closest cone, plant outside Foot and run around the cone. Continue to sprint diagonally to and run around each cone.
3	**Medicine ball side to side (Quickness) (10 throws)**	Begin by facing the wall in an athletic position with medicine ball held at your side. Throw the ball striking the wall so that it rebounds to the other side of your body.
Week 7 & 8 (3 Days per week)		
1	**15 yard turn drill(SAQ) (3 repetitions)**	Start in two point stance. Sprinting forward 5 yards to cone1 and make a Sharp Right turn around it. Sprint to cone 2 located 5 yards to the right of the start and diagonal from the first cone and make a left turn around it. Sprint 5 yards through the finish.
2	**Side shuffle(SQ) (1 minute)**	Begin in ready position- your knees and hips slightly flexed arms relaxed and to the sides, and shoulders over toes and wait for a signal. Shuffle laterally in the direction of the command from your coach without crossing your feet. This should be done by accelerating and then decelerating in order to stop as soon as subsequent commands to change the directions are given.
3	**Icky shuffle while fielding ball(AQ) (10 throws)**	Start on the left side of the ladder. Step laterally with the right foot and place It Inside the first square of the ladder then place the left foot inside the first square. Step laterally with the right foot to the right side of the ladder and then advanced the left foot to the next square in the ladder. Bring the right foot up to the square in which you have your left foot. Step laterally to the left side of the ladder and advanced the right foot to the next square of the ladder.

		Repeat this pattern. Do this while you are fielding the ball.
Week 9 & 10 (3 Days per week)		
1	**20 yard square(SAQ) (3 repetitions)**	Start in 2 point stance. Sprint 5 yards to cone 1 and make Sharp Right cut. Shuffle right 5 yards and make sharp cut back at cone 3. Backpedal 5 yards to cone 4 and make sharp left cut. Left Shuffle To cone 1.
2	**Backpedal(SQ) (3 repetitions of 50 m)**	In an athletic stance, maintain your centre of gravity over your base of support and run backwards. Increase your stride length with good form.
3	**Crossover shuffle while fielding ball(AQ) (10 throws)**	Stand with the ladder to your right. Crossover with left foot to the square of the ladder. Lateral step with right foot to the right side of the ladder. Immediately crossover with the right foot to the second square of the ladder. Laterally step with left to the left side of the ladder. Repeat. Remember only one foot is in the ladder at any one time.Do the procedure while you are fielding a ball.
Week 11 & 12 (3 Days per week)		
1	**40 yard square(SAQ) (3 repetitions)**	Start in 2 point stance. Sprint 10 yards to cone 1 and make Sharp Right cut. Shuffle right 10 yards and make sharp cut back at cone 3. Backpedal 10 yards to cone 4 and make sharp left cut. Left Shuffle To cone 1.
2	**Sprint and cut on command(SQ) (1 minute)**	Stand in two point stance. Sprint on command, cut sharply and sprint in instructed direction.
3	**Half ladder skill to pick up ball(AQ) (10 throws)**	You can perform any of the agility ladder drill while looking at your coach who is positioned on the opposite side of the ladder. React to your coach throwing a softball to either side of the ladder. React in medicine to decide to which ball is thrown and catch the ball.

Cooling protocol for experimental groups:

Sr. No.	Type of Exercise	Duration in Minutes
1	Brisk walking	2
2	Calisthenics	2
3	Static stretching	2
4	Breathing exercises	2

Standardized tests researcher is going to use are: (AAHPER Sports skills Tests – Softball for Girls)

1. **Throw for distance:**

   Description:

   Throwing line is marked off at one end of the field and the line parallel to and six feet apart from it is also marked, thus forming a zone 6 feet wide from which throw is to be made. The player takes position in the throwing zone with a soft ball in hand, takes one or two steps and throws as far as possible and as nearly at right angles to the throwing line as possible. She may throw with either hand. Small marking stick is placed at the point at which the ball first hits the ground. If the second or third throw is farther the Stick is moved to the new point. Player must be warmed up before throwing.

   Rules:

   1. Three throws are allowed.
   2. Throws must be measured at right angle to throwing line.
   3. Throw must be made from within the throwing zone.
   4. One or more steps may be taken in making the throw.

2. **Speed throw:**

   Description:

   A line is drawn on the floor parallel to and 9 Feet from a solid smooth wall with a clear space of 8 to 10 feet in width and height. The player stands behind the line with soft ball in hand. She throws the ball over hand against the wall and catches the rebound and continues throwing and catching as rapidly as possible until she has completed 15 hits on the wall. Ball must be thrown over hand and should hit the wall

about head high for a bit higher for best results. Players start on signal “go” but the time started when the ball hits the wall. Balls which fall short can be retrieved but the player must return and throw from behind the line. Two trials are timed. Practice trial is allowed.

Rules:

1. Any method of catching may be used but over hand one hand throw must be made.
2. Bad bouncers or dropped balls can be retrieved but the player must return to behind the line before resuming throwing and catching.
3. If the ball gets entirely away, 1 new trial may be given.
4. Two trials are given.

3. **Fungo hitting:**

Description:

The player stands behind home plate with bat of her choice in hand and a ball in hand. She tosses the ball up and tries to hit a fly ball into right field. She then tries to hit the next fly ball into left field. She continues hitting to the right and left alternately until she has tried to hit 10 balls to each side. A ball missed in totally does not count as a trial unless two balls are missed in succession. Each time the bat touches the ball it counts as a trial regardless of where the ball goes. After each hit the players next hit must be aimed at the opposite side. The tester can call “right” or “left” to indicate the side to which the next hit is to go.

Rules:

1. The player must try to hit to alternate sides.
2. Two entirely missed balls in succession count as a trial.
3. 20 hits are taken (10 to each direction)

4. **Base running:**

Description:

The player takes her position in the right hand batter's box, holding a bat as if ready for a pitch. On the signal "hit" the player swings at the imaginary ball, drops the bat (it must not be thrown), and runs around the bases being careful to touch each base. A practice Run is allowed.

Rules:

1. The player must stand in batter's box for right handed batter.
2. The player must complete her swing with the bat before starting to run.
3. The bat must be dropped, not thrown or carried.

4. The player must touch each base in turn On the Run.

5. Two runs are taken.

5. **Fielding Ground balls**

Description:

An area is marked out which is 17 feet by 60 Feet in size, it is crossed by a line 50 feet from the front or throwing line, and by a second line which is 25 feet from the front or throwing line. The player being tested stands inside 10 foot area beyond the 50 foot line. An assistant with a basket of 10 balls stand back of the throwing line. Spare balls are available to be used if needed. On signal "go" the assistant starts throwing grounders into the marked area at interval of 5 seconds. Each throw must strike the ground between the throwing line and the 25 foot line and within the side lines for at least one bounce. The process should go with good speed like a machine with some variation in direction, but not trying to make a fielder miss. The player must field each ball cleanly, hold it momentarily and toss it aside and be ready for the next ball. The player starts back of the 50 foot line but there after fields anywhere back of the 25 foot line. A practice trial is allowed.

Rules:

1. The Thrower should throw over hand with good speed.

2. The 5 second interval between throws must be maintained.

3. Balls must be fielded cleanly inside the prescribed area, held momentarily, and then tossed aside.

4. The throw not made as specified can be taken over. If a series of throws is badly interrupted, it may be repeated at the discretion of the tester.

6. **Catching fly balls:**

Description:

The player stands at second base in the centre of a 60 foot square. The thrower stands in the restraining zone 5 feet behind home plate and throws fly balls to player as directed. The thrower must throw the ball over the eight foot high rope which is fastened between two standards that are located 5 feet in front of home plate. The thrower must throw with regular good speed. Spare balls are available if needed. The player must catch the ball, toss it aside, and be ready immediately to catch the next ball. The tester stands behind the player being tested and indicates to the thrower weather to throw left, right or straight into the catching zone. Approximately one-third of the balls should be thrown to the right, one third to the left and one third to the

middle of the catching zone. Each player is given to trials of 10 balls each. Practice trial is allowed.

Rules:

1.Balls not thrown properly into the catching zone are not counted.

2. The ball must be thrown so that it describes an Arc in flight.

3. Total of 20 good fly balls must be thrown.

4. The player must make a good catch of each ball before tossing it aside.

Ethical Consideration:

In this research study the researcher Follow to ethical guidelines, principles, and standards for studies conducted with human beings .The study will be include safeguards for protecting humans,

The inclusion criteria are:

1. The participant will be agreeing to participate in the study.

2. The participants will be not rotating through other health facility at the time of study.

The exclusion criteria are:

1. The participants advised not to participate if under any physiological or psychological disorders.

2. Inability to obtain the questionnaire of the respondent.

3. Presence of chronic medical conditions such as asthma, heart disease or any other condition and

Statistical technique:-

The statistical computation of data of the present study is used by using Microsoft Excel Data analysis tool pack. The result computed also cross checked by using following statistical variables. Mean, standard deviation and t-test. The level of significance will be set-up at 0.05 level of confidence to test the hypothesis.

Tentative Chapters:

The present study will be divided in the following chapters:

Chapter - 1

The Chapter One outlines the background of the problem under consideration, its significance in the present scenario, the scope of the study, objectives the research intends to achieve and

hypotheses to be established. This chapter also includes the definition and explanation of important technical terms related to the study.

Chapter - 2

The Chapter Two undertakes the review of literature related to the present topic of study and tries to define the problem under consideration in a proper way. Firstly, the chapter defines important terms and concepts in a proper way to give readers an understanding of various terms in the research report. Secondly, the chapter identifies the research gaps between the problem under consideration and the available literature on the issues and strongly recommends further exploration on the problem.

Chapter - 3

This includes a detailed methodology of conducting research on the issue under consideration and various components of research design such as the universe, the sample, types of data, tools of data collection, technique of data collection, ethical consideration and methods use to analyse data.

Chapter - 4

The Chapter includes the interpretation of data and results of the study. The results of the study will be illustrated through suitable table and figure. This chapter will also include the discussion of findings.

Chapter - 5

The Chapter five summarizes the findings of the study and conclusions derived thereof. The research has also made some valuable suggestions for further research

Proposed work Plan/ Formulation and Structure of Study:

1st Year	Literature Collection Submission of Progress Report Pilot study Submission of Progress Report Start experimental test Detail study Data Collection, Compilation of data Preparation of Research Paper
	Submission of Progress Report

2nd Year	Submission of data Use of Statistical data analysis tools Preparation of Graphs Data Interpretation Final Compilation of Data Preparation of Research Paper & Communicating it for Publication Report Writing Submission of Final Report

Estimates of Research costs:

Travel Expenses	**13,000/-**
Reference books purchase	**7,000/-**
Cost of Implementation of treatment	**5,000/-**
Typing, Xerox and Binding	**22,000/-**
Other Expenses	**3,000/-**
Total	**50,000/-**

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